6.0 LESSONS LEARNED

6.1 Purpose

This section provides guidance on the proper Field input during the OR writing stage for Field 30, "Lessons Learned," and provides guidance for establishing or enhancing a lessons learned program for occurrence reporting information.

The OR lessons learned process should be designed to transfer what was learned from an event to prevent recurrence, serious injuries, and fatalities. This information should be used to refine the training of DOE, contractor staff, and contract managers.

Detailed guidance for development of a complete lessons learned program that includes collecting and distributing of lessons learned from operations information to facilities within a site and across the DOE complex are contained in DOE-STD-7501-95, *Development of DOE Lessons Learned Programs*, and the accompanying handbook, DOE-HDBK-7502-95, *Implementing U.S. Department of Energy Lessons Learned Programs*. Guidance in those documents should be used in setting up and using lessons learned programs. The resulting programs can also be used to distribute good work practices and other positive lessons learned.

6.2 Scope

This section provides information and examples to assist in determining what information should be included in Field 30 of the OR. Implementation of OR Lessons Learned can vary depending on the size and/or type of the facility site and the personnel available.

6.3 Guidance

The Occurrence Reporting order requires departmental elements and contractors at facilities to use the ORPS database for lessons learned information. The collection and dissemination to site personnel of the lessons learned from the facility's respective occurrences and the operations information obtained from other similar DOE facilities can prevent recurrence and improve operations.

6.3.1 Report Writing and Lessons Learned

Proper Field input during the report-writing stage is critical to retrieving lessons learned information. The following Fields need close attention to make the report useful in the development of lessons learned:

Subject or Title of Occurrence (Field 14)
Description of Occurrence (Field 16)

Description of Cause (Field 23)
Evaluation (Field 24)
Corrective Actions (Field 26)
Lessons Learned (Field 30)

If detailed information is missing from these Fields, the reporting value for lessons learned purposes decreases significantly. (See Appendix C, *Report Writers Guide*, for additional guidance.)

6.3.2 Purpose of "Lessons Learned," Field 30

DOE Manual 232.1-1 defines the purpose of Field 30 as follows:

"Include any lessons learned from the occurrence that could be of importance to other facility operators or that should be addressed in personnel training or facility procedures."

OR lessons learned must be integrated with those groups that actually change the way we operate, i.e., Training, Procedures, and Operations.

What this means for departmental elements and contractors at facilities is:

- Training programs should be updated to reflect new procedures and reviewed periodically to include examples (i.e., lessons learned) of incidents that have occurred. Procedures should be updated to reflect what has been learned from an incident.

- Operating personnel should be informed or provided information on significant incidents that could affect their facility. Periodic training on these incidents or inclusion into the required reading program may be appropriate avenues to transfer this information.

Start Field 30 with a brief summary of the description of the event to assist the reader in determining applicability and providing for a comprehensive lessons learned paragraph.

In a separate paragraph, present a lessons learned from the affected facility for consideration by other facilities. The listed causes (direct, contributing, and root cause) will generally provide the basis for the lessons learned.

A well-written Field 30 will provide sufficient information that can be used by other facilities to quickly review the event and evaluate its applicability.

6.3.3 Field 30 Examples:

EXAMPLE 1 - GOOD
A smoke detector in the false ceiling of the computer room activated when excessive dust became airborne due to a transformer being moved across the floor above. Procedures have been changed to include inhibiting the smoke detector alarms and implementing area surveillance for fire protection during heavy equipment moves on the floor above the computer room. Although this is a nonroutine activity, the corrective actions identified will prevent a similar event.

Lessons Learned:
1. Heavy equipment movement and maintenance or construction activities can create or stir up enough airborne particles to set off smoke detectors.
2. Erroneous smoke detector alarms can be prevented by covering or inhibiting the detectors.
3. Training documents and operating procedures need to contain explanations of what kinds of events will require inhibiting or covering smoke detectors.

EXAMPLE 2 - GOOD
Concrete blocks with lifting eyes fail when a load is applied. This type of incident has previously occurred. The cause of this and previous incidents was determined to be manufacturing defects in older concrete blocks using the Richmond eyebolt lifting scheme. This lifting scheme uses a helical steel insert that is cast into the block. The helical insert is threaded onto a mandrel which resembles the lifting eyebolt but is approximately 0.030 inches oversized. The mandrel and insert are attached to the mold and then the mandrel is removed after the concrete hardens.

Lessons Learned:
If the insert is not threaded firmly onto the mandrel or attached to the reinforcing bar in the block, then it can unscrew as the concrete is poured into the mold. The resulting lifting hole then has insufficient thread engagement into the steel insert or none at all. It is possible for trained personnel to recognize a defective block before attempting to lift it. Training and procedures have been updated to include the recognition of the defective block and actions to take upon identification.

EXAMPLE 3 - POOR
Until recently, the destructive capabilities of HALON on the ozone layer in the atmosphere were unsuspected. Now that those capabilities have been recognized, DOE and its contractors are trying to minimize all unnecessary releases of HALON to the atmosphere.

Now that the destructive capabilities of HALON on the ozone layer in the atmosphere have been recognized, it is prudent to minimize the release of HALON to the atmosphere.

EXAMPLE 4 - POOR
Although weather may have some influence on a vehicle operator's judgment, driver inattention to detail is a major factor in vehicle accidents.

Seat belts do prevent injury.

EXAMPLE 5 - POOR
If the component struck the worker's skin instead of the more vulnerable eye area, he/she would not have been injured. During the evaluation, one worker stated that he was aware of similar incidents in industrial settings, none of which, however, resulted in serious injuries. It appears that industry has not developed any lessons learned on these situations.

Eye protection requirements should be observed, not only in laboratory procedures involving recognized hazards, but also in experimental situations in which the potential for injury has not been fully evaluated.

6.4 Screening ORs for Lessons Learned

ORs should be screened for events that have a known similarity to site processes, specification of a type of equipment used at a facility or site, and generic issues of significance. Document reviews can be performed by one individual, one department, or a team with representatives from diverse functional areas of a site.

The following are examples of some methods used by various DOE sites to review ORs for applicability:

- At the site level, use a team of experts to review on a daily basis all Final DOE ORs to determine applicability to the site. The team should be comprised of people with a mixed background who are trained in and familiar with the operations and process safety of a specific facility on the site. The team members should also have a general understanding of the processes in other facilities on the site.

- At the site level, the occurrence reporting manager reviews daily all DOE ORs and coordinates the lessons learned with line managers to determine which occurrences should become lessons learned notices at the site.

- The ORPS database is reviewed two to three times each week for all occurrences submitted by the site. The reports are supplemented with a search of the complete ORPS database for occurrences similar to the event. In addition, non-ORPS reportable events at the site are identified that could have been significant, and the ORPS database is searched for occurrences that describe similar events.

- Other sources of information are reviewed such as the Office of Operating Experience Analysis and Feedback *Operating Experience Weekly Summary*, DOE ES&H bulletins, the *Occupational Safety Observer*, and lessons learned notices from other sites for occurrence information that might be relevant to your site or facility. This method of lessons learned identification is not recommended to be the only method used.

NOTE: In addition, many sites perform a formal risk analysis and establish a hierarchy to determine how the lessons learned should be distributed.

- A report is drafted and distributed to relevant personnel for review and comment. Relevant personnel may include ES&H coordinators, the department manager, the root cause analyst, subject matter experts, and line managers. Use the comments to revise the report before distributing it.

6.5 Disseminating Lessons Learned

Distribution methods vary from site to site. Most methods of distribution parallel the management chain of responsibility at the site.

The following are some ideas that have been incorporated by various DOE sites.

- The analyst, occurrence reporting manager, or occurrence reporting team, who collect the OR lessons learned information and write the reports, determine which managers might have an interest in a specific lessons learned and distribute the report to those managers.

- All OR lessons learned are distributed to all facility managers at the site. The facility managers then review the OR lessons learned and determine applicability to their facility.

- OR lessons learned points of contact are established. After an initial screening at the site level, the points-of-contact perform an additional screening to determine if the lessons learned applies. The points-of-contact route pertinent lessons learned to the appropriate manager, such that the manager can determine the means of dissemination to the workers (e.g., safety meeting, required reading, bulletin board) and any actions that should be taken at the facility as a result of the lessons learned.

- Presentations are given to front-line personnel for unique occurrences after the investigation is complete and the root cause has been determined. Worker feedback is requested on corrective actions, process improvements, and areas for additional communication.

- Lessons learned are forwarded to all lessons learned points of contact, DOE Headquarters, the DOE Field Office, identified stakeholders, and other Government-Owned, Contractor-Operated facility senior management as requested.

NOTE: Regardless of distribution, ensure that all site ORs and other applicable ORs are distributed to the training department for incorporation into lesson plans.

6.6 Feedback

Facilities vary in their use of feedback. It may be used as a means of measuring the effectiveness of the program, as a way to ensure the proper distribution of OR lessons learned, and/or to ensure the completion and follow-up of corrective actions that were identified as a result of an OR lessons learned. Ask for voluntary feedback. The following are examples of how different facilities implement feedback.

- All OR lessons learned documents are tracked in a database and feedback is required on the OR lessons learned within a certain time frame. Feedback includes the results of the evaluation of the OR lessons learned and any corrective actions, if necessary.

- A mandatory OR lessons learned feedback form is attached to all lessons learned reports. Employees must indicate if the OR lessons learned applies to their operation and why it does or does not apply. If it does apply, the employee must include what corrective actions will be taken to ensure the safety of the facility or operation. Management may choose not to implement any corrective actions, but must indicate the accepted risk on the feedback form. All corrective actions are tracked and documented in a database.

- One employee per facility/operation is appointed to ensure that the corrective actions are completed and provide a point of contact for feedback. This increases accountability and enhances the effectiveness of the feedback program.

- Feedback is required only on those OR lessons learned that have been determined to be more important by the risk analysis, or those that require a corrective action that should be tracked to completion. Other OR lessons learned notices are marked to show that no feedback is required.

- A reader survey of broad interest areas is periodically distribued. Readers are asked to identify the subject areas for which they would like more information and a suggestions/comments request is included in the survey.

6.7 Additional Benefits of Lessons Learned

The value of the occurrence reporting lessons learned information is clearly evident when used as a proactive management tool that prevents unwanted occurrences or allows the adoption of good practices. However, the OR lessons learned program value is greatly enhanced when used interactively with other related management tools.

The following are discussions of OR lessons learned interaction/information that flow between lessons learned and other related functional elements that enhance the program value.

6.7.1 Investigations

Many occurrences necessitate a Type A or B investigation. The investigation process should include a historical lessons learned search to identify any similar lessons learned. If similar lessons learned are found, the investigation should identify why the lesson was not learned the first time to preclude recurrence. This provides valuable information flows from the lessons learned program to benefit the investigation process. Additionally, the investigation process should provide information flow into the OR lessons learned Field 30, allowing others the opportunity to proactively benefit from the investigation results.

6.7.2 Assessment & Surveillance

The self-assessment and surveillance process frequently identifies new lessons to share with others through the Occurrence Reporting Program. The OR lessons learned information can provide the proactive manager with new self-assessment topics.

6.7.3 Tracking

The ORPS provides opportunities to group similar operational information that identify generic/crosscutting issues and lessons learned.

6.7.4 Root Cause Analysis

The product of the causal analysis process provides one of the fundamental ingredients of a well-written lessons learned. Historic lessons learned reports on similar occurrences can aid in validating the causal analysis process.

6.7.5 Prioritization

Upon receipt of applicable lessons learned, the prioritization and risk analysis process should be applied as with any other identified issue.

6.7.6 Trending

Trending of similar lessons learned provides for early indications of deteriorating conditions or identifies strengths to be continued from the overall perspective. This process of trending the operational information often provides lessons learned to be shared with others.

6.7.7 Lessons Learned

The occurrence reporting process provides a major source of lessons learned information to all DOE and contractor operations.

Figure 6-1
Examples of
Lessons Learned Bulletins

Title: CHEMICAL RELEASE RESULTS IN OBSERVATION AT HOSPITAL FOR WORKERS

Date: 4/3/95 Originator: Imelda Francis, Sandia National Laboratories

Statement of Lessons Learned: The following lessons learned, if applied, would have helped reduce the severity in all three occurrences:

* Health and Safety Plans (HASPS) and Standard Operating Procedures need to consider a spectrum of normal to emergency situations and be thorough and consistent. Proper review, approval, and training in their implementation need to be completed prior to start-up. Emergency Plans should be documented and communicated to all personnel likely to be impacted.

* When planning any type of test or facility modification, communication of the activity and channels for the exchange of information in off-normal conditions must be given to personnel in neighboring areas that might possibly be affected.

* Employees need to understand the dangers of the materials they are working with and call appropriate numbers per the Sandia/NM and Sandia/CA Quick Reference Information Card (Yellow Card).

Discussion of Events:
On December 12, 1994, a chemical vapor release occurred as a result of experiments being conducted at a Sandia Environmental Restoration Site located in Technical Area III. The release came from a portion of the site involved in the Thermal Enhanced Soil Vapor Extraction System (TEVES) test. An over temperature condition caused an automatic shutdown of the TEVES which released the negative pressure placed on the heated soil. The loss of vacuum allowed soil vapors to escape. Odors detected by workers at a nearby environmental restoration site, led the workers to approach the TEVES site to determine the source of the odors. Some of these workers experienced minor physical symptoms. Restoration the site personnel decided to close their area and as a precaution; all nine workers went to a local hospital emergency room (it was after hours and Sandia medical department was closed). Eight of the workers were observed and released; one worker, who had a preexisting condition, was released the next day.

Note: Two similar recent occurrences at Sandia illustrate how activities in one area impact personnel in another area. In July 1993, a SNL/CA employee was hospitalized after he was exposed to hydrogen sulfide (H^2S) gas that escaped through a vent when he was working in a loft above a lab where experiments were being conducted. In October 1994, two Sandia/CA employees were refilling the excimer laser when a fluorine gas leak was discovered in a cylinder valve.

All were taken to the hospital emergency room, evaluated, and released after exposure to the gas; for both instances, personnel in the facility were evacuated to avoid potential exposure to the toxic gas.

Analysis:
* The TEVES personnel didn't recognize the off-normal conditions that existed, with potential for impact outside the TEVES site, because they were unaware of restoration site personnel investigating the situation.
* Prior planning for such an event was less than adequate. This planning would have included methods for communication of an off-normal situation to personnel in neighboring areas.
* After noticing the odors, the workers from the neighboring area approached the TEVES site without respiratory protection or monitoring equipment.

Contacts: SNL/NM, Lonnie Martin, ES&H Coordinator Dept. 6600, (505) 844-6142, SNL/CA; Barry Schwartz, ES&H Coordinator Dept. 7500, (510) 848-0418, SNL/CA; Donn Wright, Dept. 8641, (510) 294-2615
References: DOE Occurrence Report No. ALO-KO-SNL-6000-1994-0002
Type C Investigation Report of a Chemical Release at the TEVES at SNL/NM
Authorized Derivative Classifier: Paul Yourick, Contains NO Classified Data
Priority Descriptor: YELLOW/CAUTION
Functional Category: Worker Protection Objectives
Keywords: chemical, environmental, restoration, TEVES (Thermal Enhanced Soil Vapor Extraction System)

Title: Carpenter Injured in Platform Lifting Incident

Identifier: Y-1995-OR-LMESY12-1101 Date: 11/15/95

Lesson Learned:
Numerous causes contributed to a lifting accident, which resulted in an injury. These causes included less than adequate: hazard recognition, training and awareness, work planning, supervisory oversight, communication, and technical information.

Discussion:
On August 10, 1995, carpenters were erecting a 10-foot-high enclosure inside Building 9201-3 using a work-lift platform to raise a roof panel weighing 117 pounds to the top of the enclosure. Before reaching the top of the enclosure, the panel fell off the lift and struck one of the carpenters, lacerating the left side of his face and bruising his right shoulder. The injured carpenter was treated at a local hospital and released.

An investigation team was formed. During the investigation, interviews were conducted with four planners, five carpenters, three supervisors, four members of the Y-12 Hoisting and Rigging Committee, three training personnel, and customer and managerial personnel. The investigation team used the Management Oversight Risk Tree (MORT) analysis methodology in analyzing and evaluating the events and conditions leading up to the accident. The root causes — hazard recognition, work planning, training or awareness, supervisory oversight, communication, and technical information— were determined to be less than adequate (LTA).

Hazard Recognition Less Than Adequate (LTA). The carpenters placed themselves near or under an unsecured load and operated the work platform improperly by loading the panels on the handrails. The Operations and Maintenance (O&M) manual for the lift was not consulted. The potential for hazards was not adequately recognized in any of the safety evaluation documents (OSWP, Job Hazard Analysis [JHA], planning checksheets, etc.) or in the job instructions and crew briefing. Each of the five carpenters interviewed stated that they recognized they had stop work authority, but none of them recognized the need for it during the activity leading to the injury.

Training or Awareness LTA. The lift was used improperly. The work platforms and rails were not removed before loading the material, and the outriggers were not positioned properly. The O&M manual does provide sufficient instructions for configuring this lift to raise material, but it was not consulted and was not readily available. No training is currently offered at Y-12 for work platforms such as this lift.

Planning LTA. The planning of this job was assigned to three successive planners over a seven-month period due to startup delays and continuity was not present. There is no clear definition of requirements in the Planners Guide regarding the amount of detail to be included in job instructions. The job package did not provide information about the method of accomplishment for raising the roof panels.

Oversight LTA. The supervisor of this work was monitoring three separate jobs on the day of the accident. He had responsibility for 13 workers in four separate crafts. Multiple job assignments are typical for maintenance supervisors, and collateral responsibilities have increased significantly due to downsizing. The supervisor had conducted his regular, daily, crew briefing on the morning of the accident, but it took place at the crew area, not at the job site. The supervisor was not aware of the instructions contained in the lift's O&M manual. He was not aware that a "T-stick" was being used to balance the panels. He had not monitored any work activities for this job on the day of the accident.

Communication/Interfaces LTA. Communication was ineffective between the requester of the OSWP, the supervisor, and the planner, when completing the OSWP, to determine the scope of the job or the method of accomplishment.

Technical Information LTA. Plant documentation and training programs do not address the use of work platforms.

Recommended Actions:
1. The hazard recognition process should be evaluated.
2. The training needs for Operational Safety Work Permits (OSWPs) and other similar safety documentation should be evaluated.
3. Material lifting activities where mechanical advantage is used should be evaluated to ensure that all such activities are appropriately addressed by plant programs.
4. The duties and responsibilities placed on supervisors should be evaluated and an action plan developed for establishing appropriate priorities, including the time allowed for monitoring jobs.
5. The Planner's Guide requirements should be evaluated regarding the appropriate level of detail in job package components.
6. A request should be submitted to the central training organization for modification of the Training Management System (TMS) to provide easier tracking and awareness of training expiration dates by supervisors.
7. Mechanisms for communication and interface among the customers, planners, and supervisors for the Work Control Center in question should be evaluated and an action plan developed for implementation of the enhancements.

Originator: Lockheed Martin Energy Systems, Inc.; Y-12 Site, J. C. Bell, (423) 574-8011
Contact: J. C. Bell, (423) 574-8011
Name of Authorized Derivative Classifier: D. C. Wright
Name of Reviewing Official: P. L. McKenney
Priority Descriptor: YELLOW/CAUTION
Functional Category: 430 - FACILITY OPERATIONS
Keywords: OSWP, JHA, hazard, hazard recognition, lifting, platform lift, supervisor, planner, occupational safety, training, communication
References: "Type C Investigation, Carpenter Accident in Building 9201-3, August 10, 1995," issued September 12, 1995; ORO--MMES-Y12SITE-1995-0022; Operating Experience Weekly Summary, #95-33, Article 5, "Roof Panel Falls and Injures Carpenter;" Supervisor's Guide, Procedure 10-35-009; Planner's Guide, Procedure Y10-35-008

Title: YELLOW - Dropped Load During Hoist Operation

Identifier: LMIT Lessons Learned # 95196 Date: 06/14/95

Lessons Learned Statement:
Work control documents must be "stand alone" including detailed planning steps that clearly define how the work should be accomplished. Vendor manual instructions must be reviewed for guidance and should be included as reference in the work control document when feasible.

Discussion of Activities:
On March 9, 1995, a Test Reactor Area Maintenance Operations (TRAMO) mechanic was reinstalling a cement shield block over the warm waste pit located in the basement of the inactive Engineering Test Reactor (ETR). The mechanic was using the installed 4-ton monorail electric hoist to handle the 8,000 pound shield block. The shield block had been removed in support of decontamination and decommissioning assessment activities. The mechanic picked up the load, positioned the shield block over the opening and began lowering the shield block. When the shield block was approximately 6 to 8 inches from being fully inserted, the hoist cable pulled free of its dead-end terminating device causing the load to drop. No damage or injuries resulted from this failure; however, the potential for damage and/or injury existed. Similar Occurrence Report Numbers: ID--EGG-ATR-1994-0027; ID--LITC-TRA-1995-0002

Analysis:
The wire rope for the electric hoist was replaced on March 23,1992, due to damage (kinking and crushed wires) noted during the tri-annual inspection. The detailed planning steps in the original work control document for change out of the wire rope did not provide any instructions on how to properly install and torque the wire rope clips. The document simply stated "attach end fittings and string the new wire rope in the same manner as the old wire rope." The work control document did not reference the wire rope clips vendor manual instructions for installing and torquing the wire rope clips. The vendor manual gives very specific instructions on the number of clips to use, amount of turnback on the wire rope, and the recommended bolt torquing requirements for the clips prior to and after load-testing the wire rope. No other deficiencies were noted from the periodic inspections made on this hoist after the wire rope was replaced. It was concluded that the wire rope clips were not properly torqued after being installed, and the clips were not inspected, including checking the torque, after the load test was performed. The work control document that was used for the wire rope replacement does not meet the standards that are in place today for this type of work. A review of work control documents that have been used recently to replace wire rope on several other hoists and overhead cranes at TRA revealed that detailed instructions are contained and/or reference the vendor manual instructions.

Recommended Actions:
Management and DOE-ID were immediately informed of the event. Line management placed a moratorium on the use of all cranes and hoists pending the results of the event investigation. The 4-ton hoist in ETR was danger-tagged out of service. A critique for this event was held on March 10, 1995. TRAMO planners were given instruction/training on the need to maintain high standards currently in place for all work control documents they generate. Engineering and a certified crane inspector have completed an evaluation and visual inspection of all lifting equipment at TRA for similar attachment devices. Of the 35 cranes and hoists at TRA, six hoists were found to have the same or similar wire rope dead-end configuration and/or attachment devices. These hoists were danger-tagged out of service and will be evaluated before returning to service. The results of the aforementioned inspections will be used to upgrade the prevent maintenance inspection detailed planning steps, to include proper installation and torquing of wire rope clip bolts in accordance with the vendor manual instructions, for those cranes and/or hoists having similar attachment devices. Engineering will review the lessons learned from this event and will coordinate with TRAMO planning to ensure that the applicable vendor manual instructions are contained and/or referenced in future work control

documents. Engineering has completed an evaluation of the electric hoist and is developing a corrective action plan to return the hoist to service.

Originator: LMIT Lessons Learned Program Office
Contact: Myron F. McMillan (208) 533-4211
Name of Authorized Derivative Classifier: N/A
Name of Reviewing Official: Myron F. McMillan
Functional Category(s): 4.0 WORK PRACTICES
Keyword(s): hoist, dropped load, procedure inadequacies
References: Occurrence Report ID--LITC-TRA-1995-0004